

WHAT IS CLAIMED IS:

1. A method of determining an overlay error between two layers of a multiple layer sample, the method comprising:

for each of a plurality of periodic targets target that each have a first structure formed
5 from a first layer and a second structure formed from a second layer of the sample,
measuring a plurality of optical signals at a plurality of incident angles, wherein there are
predefined offsets between the first and second structures; and

10 determining an overlay error between the first and second structures by analyzing the
measured optical signals at the plurality of incident angles from the periodic targets using a
scatterometry overlay technique based on the predefined offsets without using a calibration
operation.

2. A method as recited in claim 1, wherein the plurality of measured optical
signals for each target are obtained simultaneously.

15 3. A method as recited in claim 2, wherein the plurality of measured optical
signals for each target are obtained simultaneously by a simultaneous, multiple angle of
incidence ellipsometer.

4. A method as recited in claim 3, wherein the ellipsometer includes a plurality
of detector elements that are each arranged to detect a one of the plurality of measured
optical signals for each target.

5. A method as recited in claim 1, further comprising comparing the measured optical signals to theoretical data to thereby obtain parameters of the periodic targets.

6. A method as recited in claim 1, further comprising comparing the measured optical signals to theoretical data to thereby adjust the model used to generate the theoretical data.

7. A method as recited in claim 2, wherein the plurality of measured optical signals for each target are obtained simultaneously by a beam profile reflectometer.

8. A method as recited in claim 2, wherein the plurality of measured optical signals for each target are obtained simultaneously by an Optical Fourier Transform reflectometer.

9. A method as recited in claim 2, wherein the plurality of measured optical signals for each target are obtained simultaneously by an Optical Fourier Transform ellipsometer.

10. A method as recited in claim 2, wherein the plurality of measured optical signals for each target are obtained simultaneously by an Optical Fourier Transform polarized reflectometer.

11. A method as recited in claim 1, wherein each first structure has a first center of symmetry and each second structure has a second center of symmetry and wherein the first center of symmetry and the second center of symmetry for each target are offset with respect to each other by a selected one of the predefined offsets.

12. A method as recited in claim 1, wherein the overlay error is determined without comparing the measured optical signals to calibration data.

13. A method as recited in claim 1, wherein the scatterometry overlay technique is a linear based technique.

5 14. A method as recited in claim 1, wherein the scatterometry overlay technique is a phase based technique.